

Technology Opportunity

Advanced Bearings, Seals, and Solid Lubricants Enable Oil-Free Turbomachinery

The National Aeronautics and Space Administration (NASA) seeks to transfer technologies for advanced foil air bearings, seals, and solid lubricants. These technologies are currently being applied to advanced turbomachinery.

Potential Commercial Uses

- Oil-free (turbo) refrigeration compressors
- Oil-free turbochargers
- Oil-free “hybrid” electrical turbogenerators
- Oil-free aeropropulsion engines

Benefits

- Improves efficiency, lower friction
- Increases operating temperatures
- Reduces emissions
- Eliminates contamination (process fluid used as lubricant)
- Lowers weight (by eliminating oil systems)

The Technology

Advanced foil air bearings, seals, and high-temperature solid lubricants are being developed by NASA and industry to solve key aerospace engineering challenges. Foil air bearings are compliant, self-acting hydrodynamic bearings that provide low-friction shaft support by using ambient air as the “lubricant.” Such bearings are well suited to high-speed, lightly loaded applications, and once started, experience no wear. Since no oil lubricants are used, foil air bearings can operate at temperatures up to 1200 °F. For startup and shutdown protection, NASA developed high-temperature solid lubricant coatings to enable successful bearing applications.

The foil air bearings have already been used in turbocompressors and in turboalternators on commercial aircraft. Currently, Glenn is working with industry to extend the technology to an oil-free

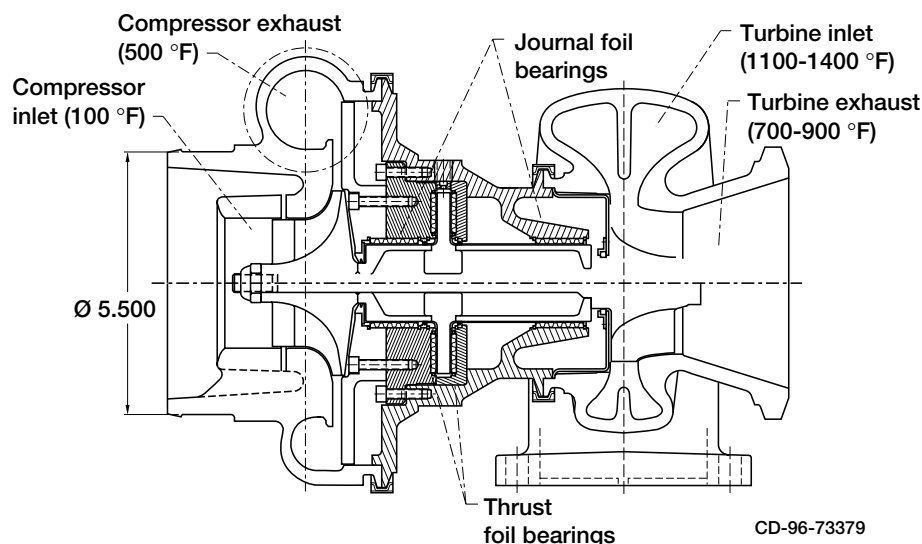


Figure 1.—Oil-free turbocharger.



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turbocharger for heavy-duty applications. This turbomachine (see fig. 1) can reach 120,000 rpm at a bearing temperature of 1000 °F and increase efficiency by 10 to 15 percent because of the reduced bearing friction. In addition, because there are no oil lubricants, there are no seal-leakage-induced emissions (particulate/soot) and no additional stresses on the engine oils.

Options for Commercialization

Patents covering bearings and solid lubricant coatings are in place or being applied for. Current turbocharger project partners are Schwitzer, Caterpillar, and Mohawk Innovative Technologies; however, opportunities for additional applications in turbomachinery are under consideration.

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Key Words

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References

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